= DE 44 10 306

(12) UK Patent Application (19) GB (11) 2 288 003 (13) A

(43) Date of A Publication 04.10.1995

(21) Application No 9506099.2

(22) Date of Filing 24.03.1995

(30) Priority Data
(31) 4410306 (32) 25.03.1994 (33) DE

(71) Applicant(s)
GKN Gelenkwellenbau GmbH

(Incorporated in the Federal Republic of Germany)

Westendhof 5-7, D-45143 Essen,
Federal Republic of Germany

(72) Inventor(s)
Ditmar Klischat
Wilfried Gille

(74) Agent and/or Address for Service
Forrester Ketley & Co
Chamberlain House, Paradise Place, BIRMINGHAM,
B3 3HP, United Kingdom

(51) INT CL[6]
F16D 1/116

(52) UK CL (Edition N)
F2U U226 U376
U1S S1644

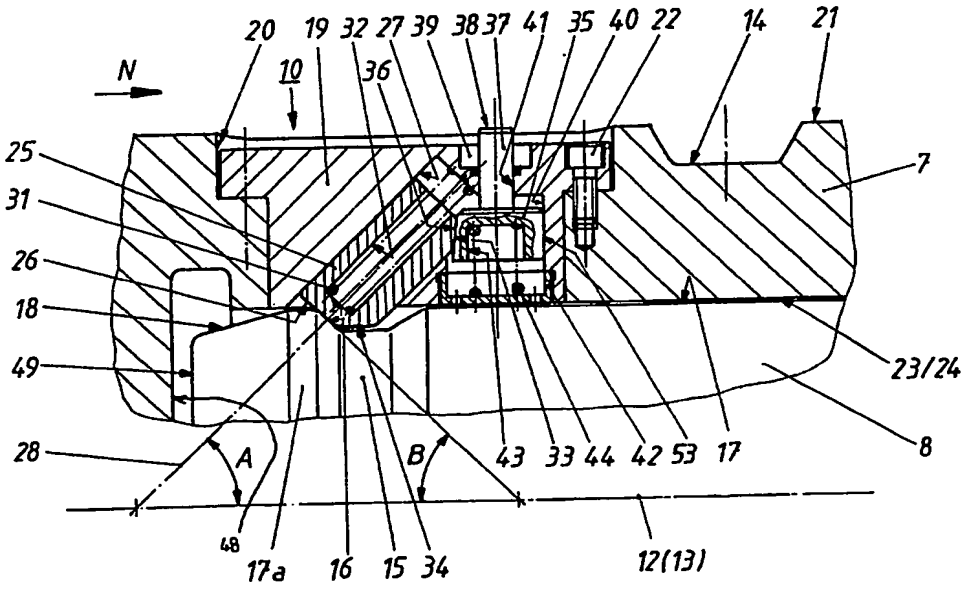
(56) Documents Cited
GB 1225666 A GB 0879254 A US 4283158 A

(58) Field of Search
UK CL (Edition N) F2U
INT CL[6] F16D 1/116
Online: WPI

(54) Shaft coupling

(57) A coupling for connecting a coupling sleeve (7) to a coupling journal (8), has a bolt member (25) displaceable under a spring force in a direction to engage a bolt face (26) of the bolt member with a locking face (16) of a locking recess in the coupling journal, the bolt member being able to be locked in a retaining position by a resiliently biased locking element (35) which can only be moved into a releasing position by application of a force from the outside of the coupling sleeve, the bolt member being received in a bore whose axis lies in the same plane as the longitudinal axis of the coupling sleeve and which intersects the longitudinal axis at an acute angle.

Fig.4



GB 2 288 003 A

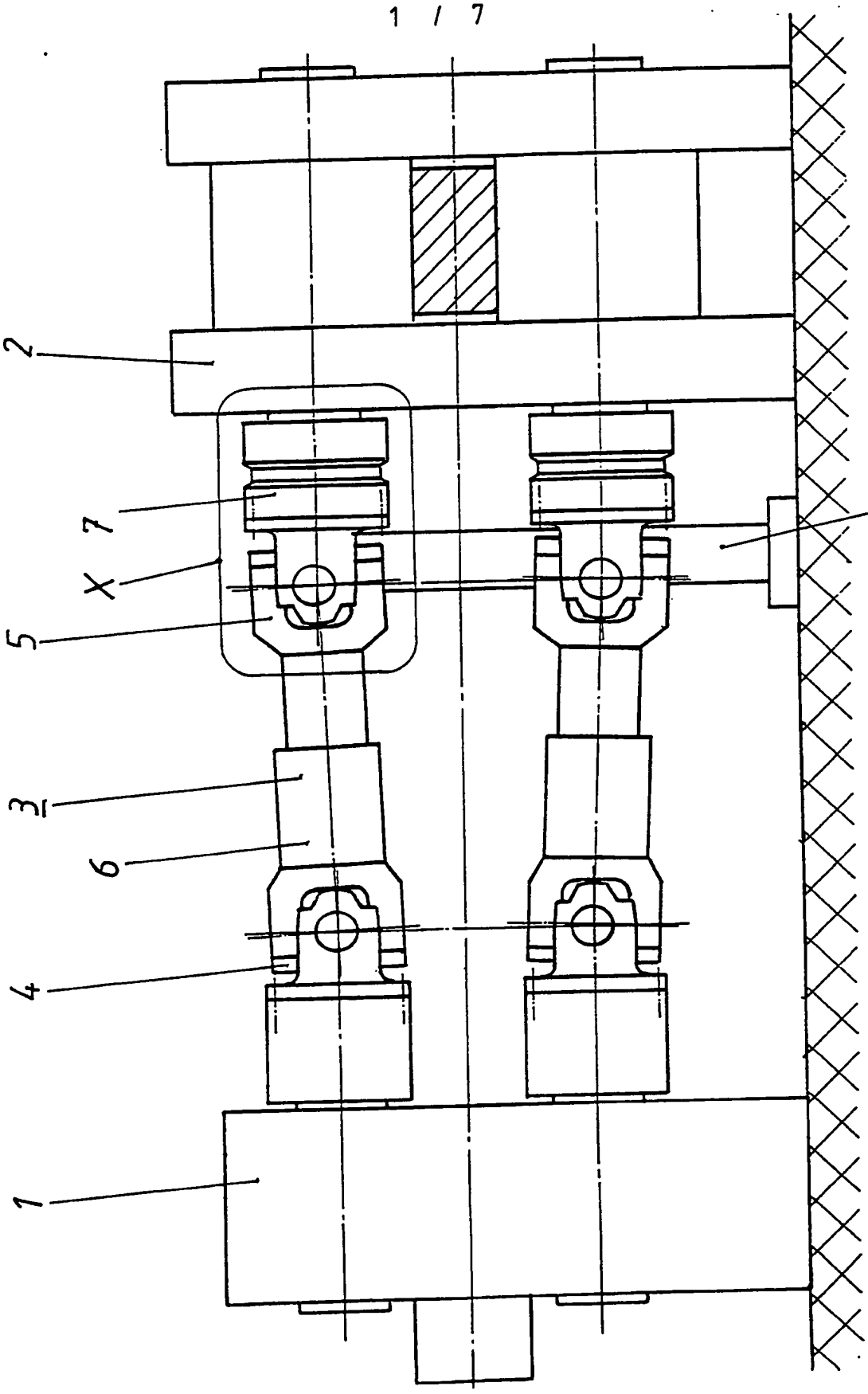


Fig.1

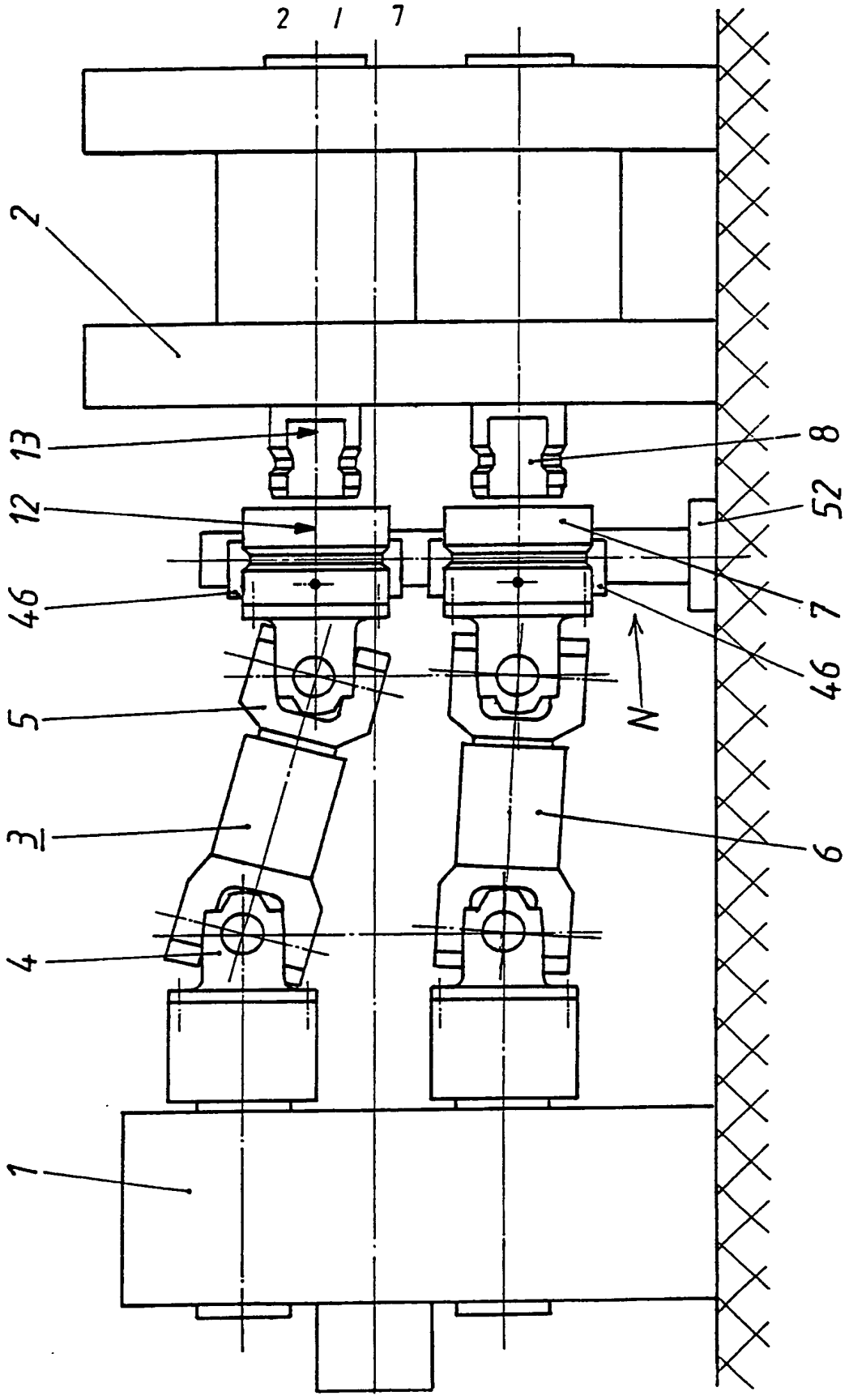


Fig.2

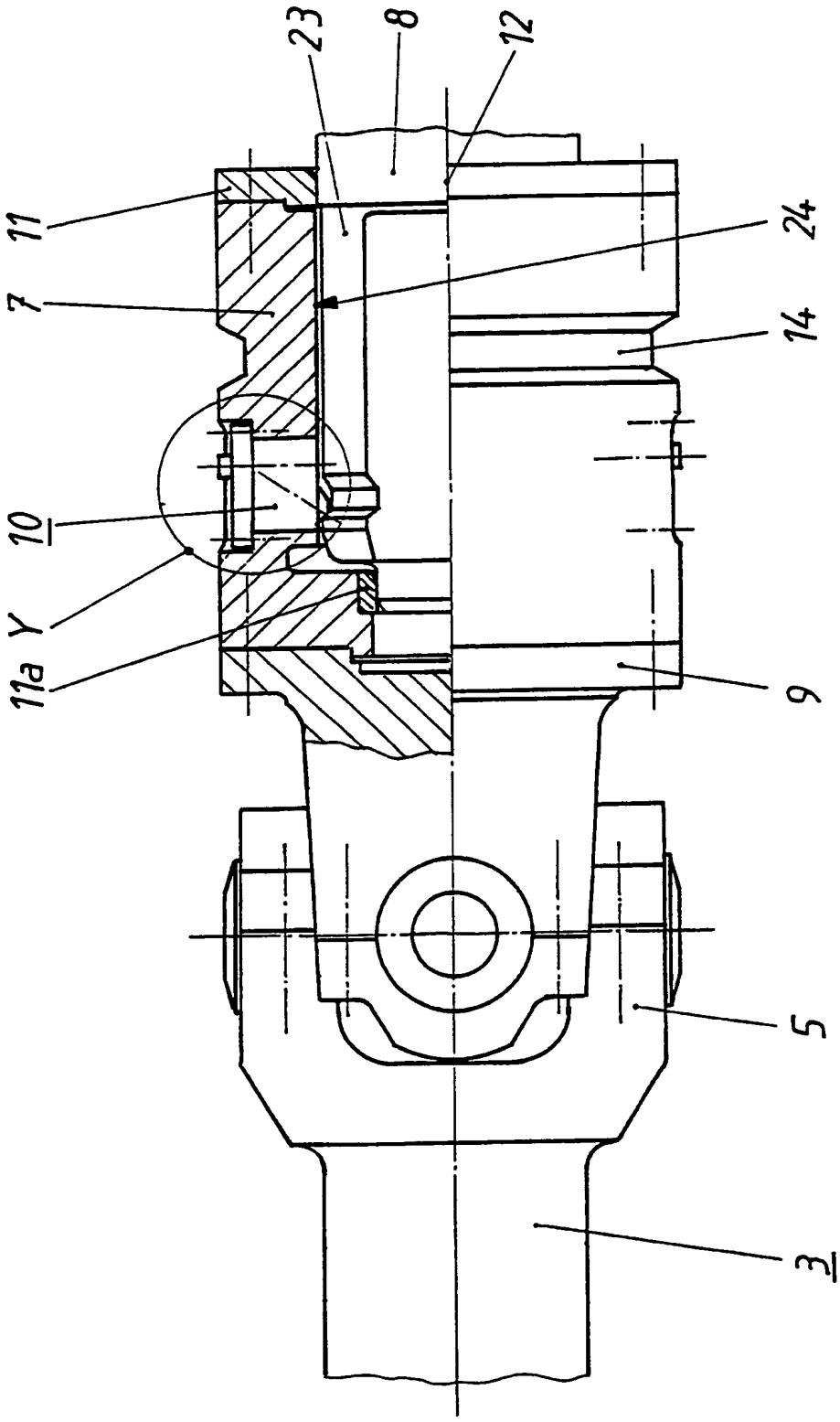


Fig.3

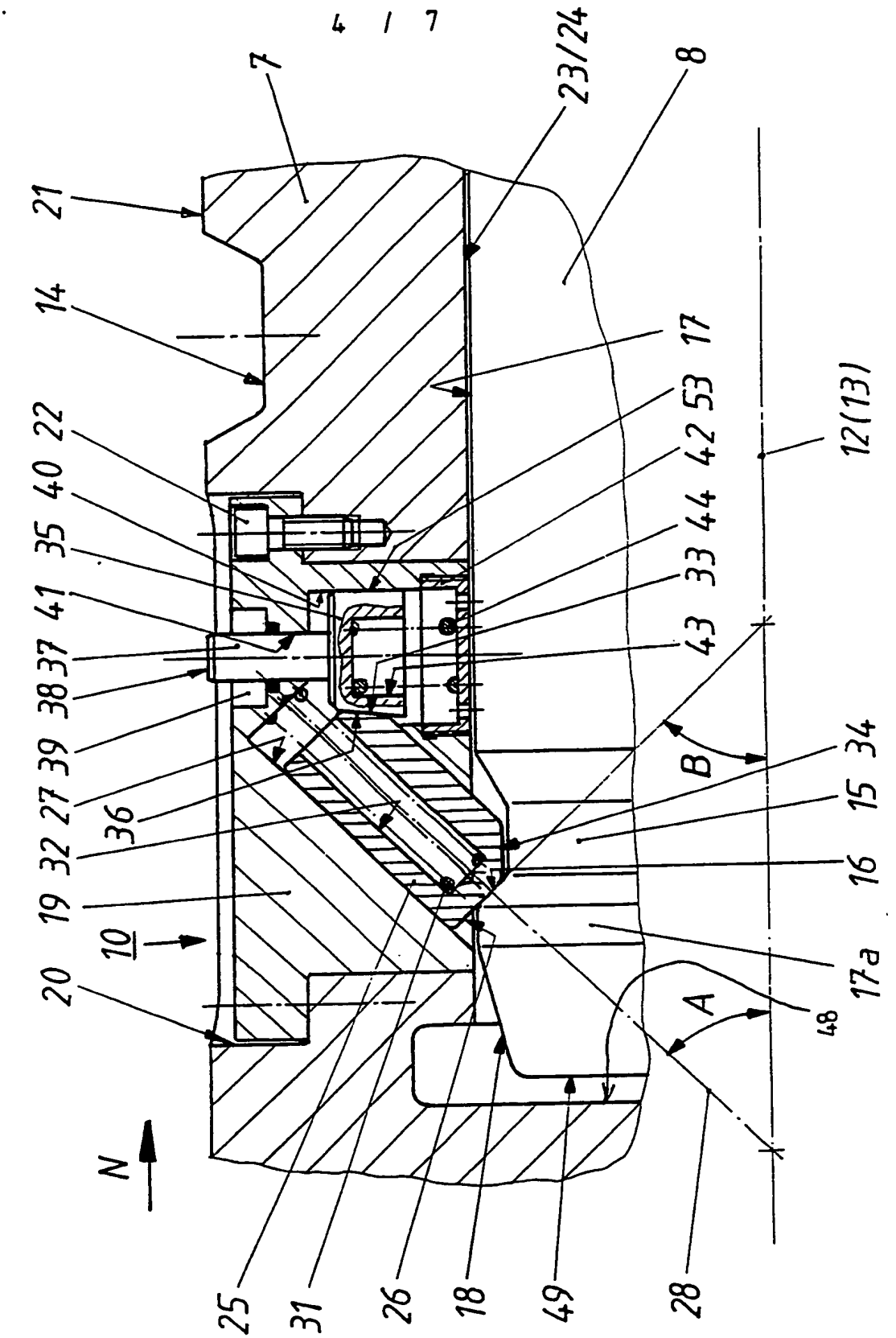

7
23/24
8
21
14
17
22
40
35
41
37
38
39
27
36
32
19
10
20
53
42
44
33
43
12(13)
B
34
15
16
17a
48
A
25
31
26
18
49
28
N

Fig. 4

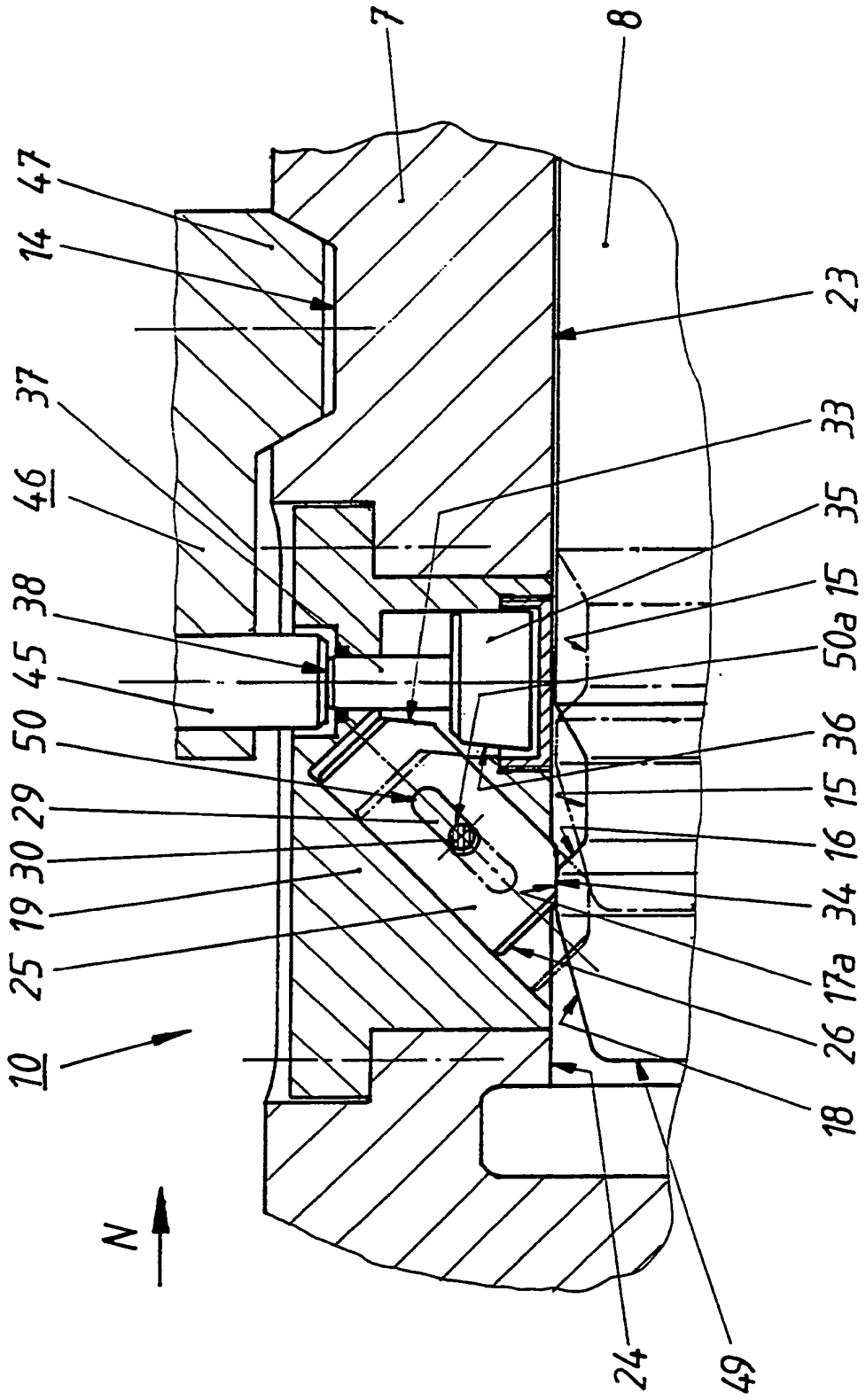

7
8
47
14
23
37
33
46
35
38
15
50a
45
50
36
29
15
16
30
34
19
17a
25
26
10
18
N
24
49

Fig. 5

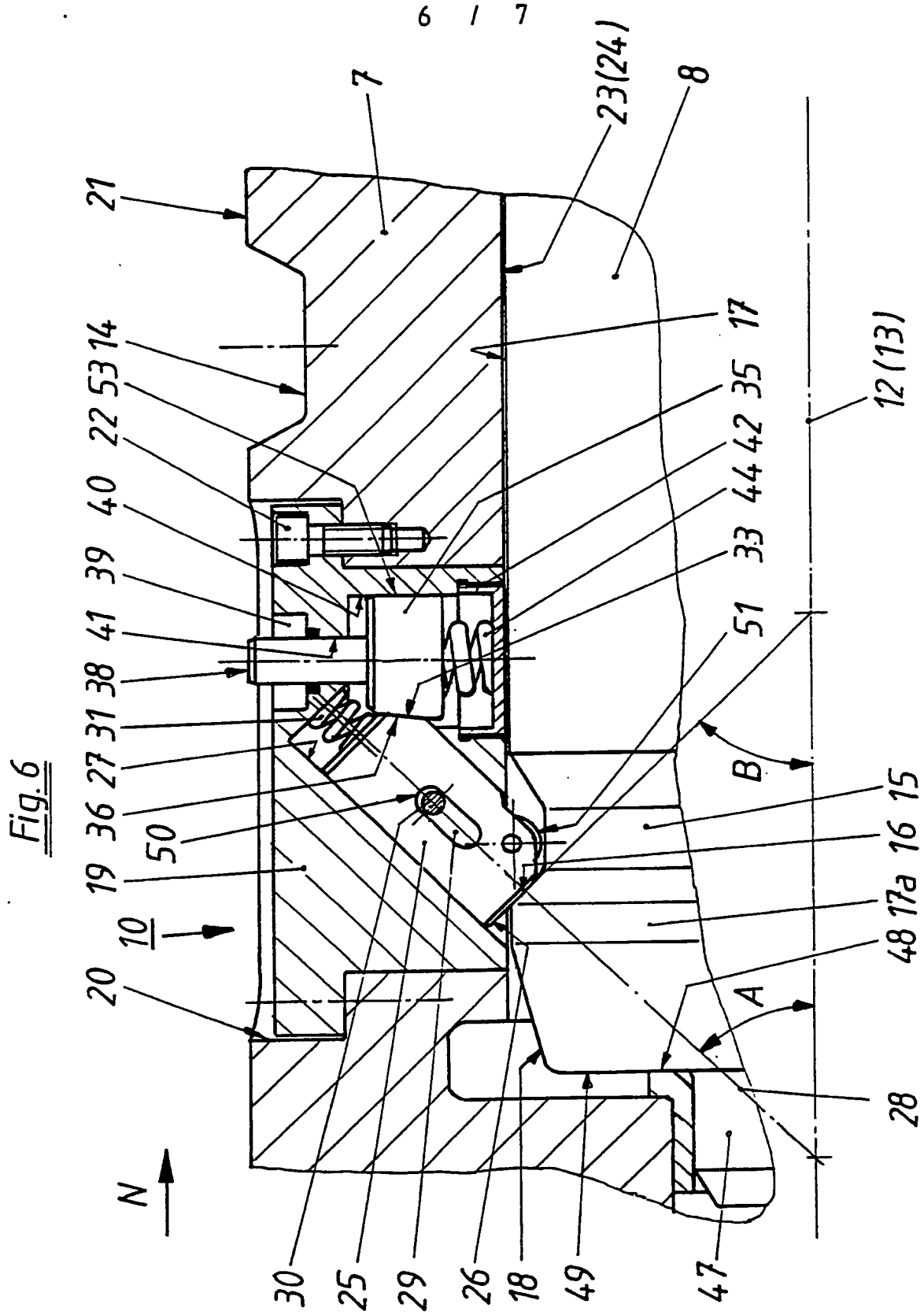
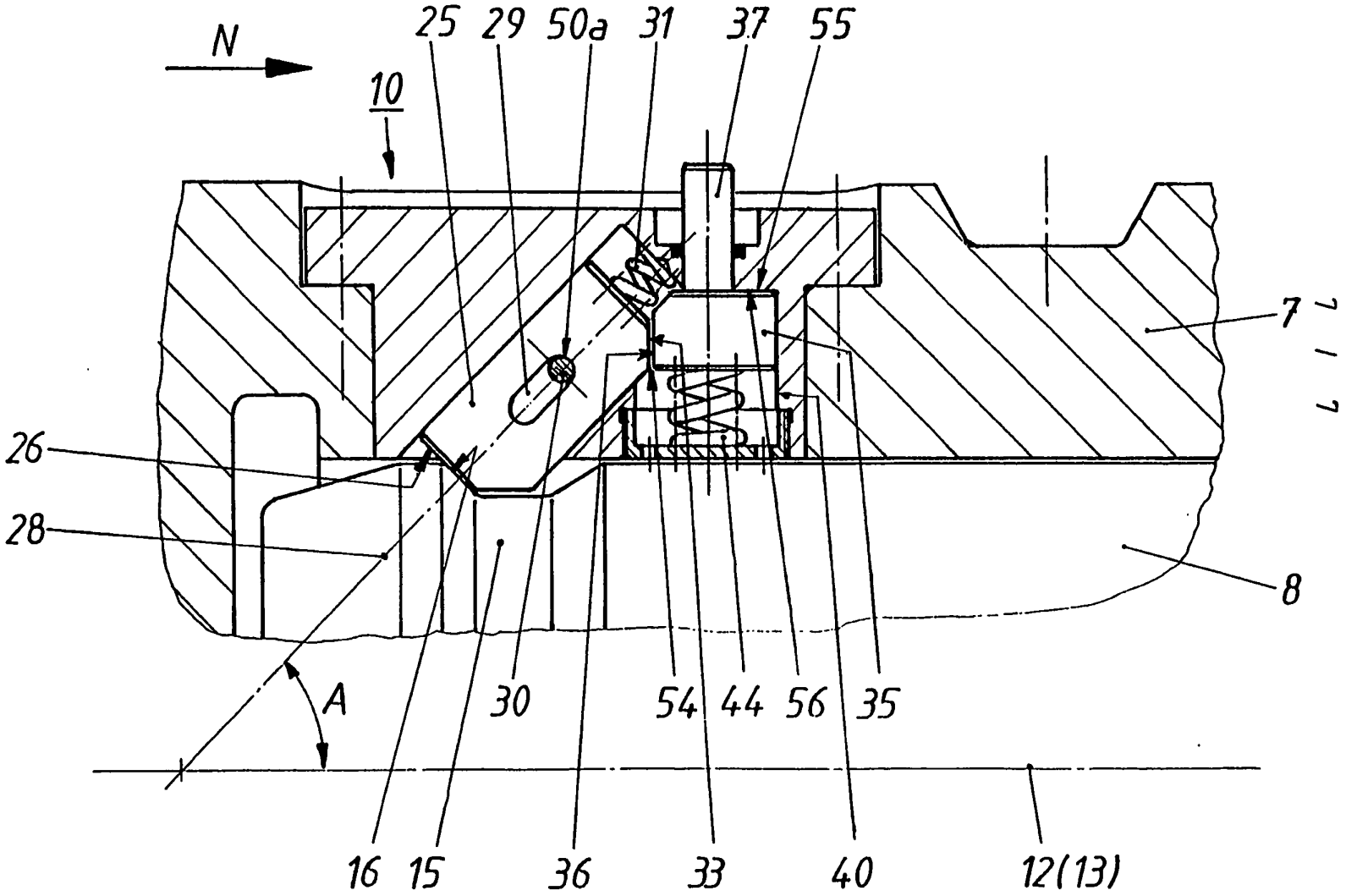

7
23(24)
8
21
17
14
53
22
35
42
44
40
39
33
41
51
38
31
27
36
50
19
10
20
B
15
16
17a
48
A
28
12(13)
N
30
25
29
26
18
49
47

Fig. 6

Fig. 7



2288003

PATENTS ACT 1977

GMD/A8472GB/D16

Title: COUPLING

Description of Invention

This invention relates to a coupling, by which a releasable connection is established between a coupling sleeve and a coupling journal, the coupling sleeve comprising a bore in which the coupling journal is received when in the coupled condition, the journal being insertable into the bore in the sleeve lengthwise of a longitudinal axis of the sleeve and journal, and there being releasable means for retaining the sleeve relative to the journal, against disconnection by relative movement therebetween in the opposite direction; such releasable means comprising a locking recess provided in an outer surface of the coupling journal and having a locking face, a bolt member having a bolt face cooperable with the locking face and which is movable between a first position, herein called the retaining position, in which its bolt face projects inwardly of the bore of the coupling sleeve and a second position, herein called the disconnecting position, in which it is withdrawn from the bore, there being a resiliently biased locking element for locking the bolt member in its retaining position and which may be, by application of an external force, moved into a releasing position.

Such a coupling will hereafter be referred to as a coupling of the kind specified.

A coupling of the kind specified is described in US-4392759. The coupling journal has an external profile with splines and a continuous annular groove. The coupling sleeve has a complementary splined profile in its bore and the wall of the coupling sleeve is provided with a radially extending stepped bore in which there is inserted a bolt which, at its end having a smaller diameter, has a bolt face cooperable with the continuous groove of the coupling journal. The bolt is mushroom-shaped and has an enlarged head which engages a portion of the radially extending bore in the sleeve which is of increased diameter. Between the step in the bore and the enlarged head of the bolt there is disposed a spring

which biases the bolt outwardly to disengage it from the groove in the journal. On the coupling sleeve there is disposed an axially movable collar which constitutes a locking element which is loaded by a spring towards a locking position and which, by an inclined surface, loads the bolt towards its engaged position. To be able to slide the coupling journal into the coupling sleeve, the locking element has to be displaced until the bolt, under the action of its spring, is able to move outwardly. With the journal engaged in the sleeve, the locking element can be moved axially relative to the sleeve to move the bolt inwardly.

DE-AS-1273918 describes a coupling having a coupling sleeve and coupling journal which have respective bores corresponding to one another and extending at an angle relative to the longitudinal axis of the coupling. The bore of the coupling journal holds a bolt which, by means of a resilient rubber element, is urged into an engaged position relative to the bore of the coupling sleeve. By means of a tool, the bolt may be moved out of its engaged position against the force of the rubber element. The coupling sleeve has an inclined face which, when the sleeve and journal are moved together, pushes the bolt against the force of the rubber element into its disengaged position to facilitate the coupling operation.

DE-GM-1921517 describes a coupling wherein the coupling journal (attached to a roll which is to be driven) has a generally rectangular cross-section but with a partly cylindrical outer face, and is received in a bore of corresponding cross-sectional shape in the coupling sleeve. The coupling sleeve forms part of a drive shaft which permits a change in length between its two ends so that, by shortening the length of the drive shaft, the coupling sleeve may be pulled off the journal. In the opposite sense, by lengthening the drive shaft, the coupling sleeve may be slid on to the coupling journal in the coupling direction. It is necessary to be able to fasten or unfasten the coupling in such a way when changing rolls in a rolling mill, for example.

It is broadly the object of the present invention to provide a coupling of the kind specified which provides a firm connection between the coupling

journal and coupling sleeve in the axial direction, and which automatically has an arresting effect when sliding the coupling sleeve on to the coupling journal or when sliding the journal into the sleeve. A secure connection should be provided in the coupled condition.

In accordance with the present invention, a coupling of the kind specified is provided wherein the bolt member is resiliently biased towards its retaining position and, when the locking element is in its releasing position, may be displaced into its disconnecting position by movement of the coupling sleeve relative to the coupling journal opposite the direction (herein called the coupling direction) in which the sleeve approaches the journal when being coupled thereto, and reassume its retaining position when external force is no longer applied; the axis of the bore wherein the bolt member is received lying in the same plane as the longitudinal axis of the coupling sleeve and intersecting said longitudinal axis at an acute angle facing in the coupling direction.

In the course of a coupling operation, the bolt member ensures that the coupling sleeve is retained relative to the journal with respect to movement opposite the coupling direction. To prevent the coupling from being unfastened unintentionally, additional security is provided by the locking element which can only be moved into its releasing position by the application of external forces. When engaging the bolt member, the locking element automatically assumes its securing position when the bolt member, by virtue of its resilient biasing, is in its retaining position. If there is arranged to be a permanent contact between the bolt member and the locking element when the bolt member is in the retaining position, any forces acting on the bolt member against the coupling direction are transferred in a clearance-free way into the coupling sleeve by way of the locking element. As a result, the coupling is prevented from being disconnected.

The bore for receiving the bolt member is preferably disposed at an angle in the range of 45° to 55° relative to the longitudinal axis of the sleeve.

Preferably the bolt member comprises a pin or other member of elongate configuration, movable lengthwise in a bore, an end face of the pin constituting the bolt face.

Preferably the bolt face of the bolt member is inclined to the longitudinal axis of the receiving bore of the coupling sleeve, and the locking face of the locking recess in the journal is inclined to the longitudinal axis of the journal, at identical angles to one another. Preferably such angles are acute angles in the range 45° to 55°, opening in the direction opposite the coupling direction: this is desirable to ensure an easy uncoupling operation.

When the bolt member is of cylindrical configuration, anti-rotation means may be provided to prevent it from rotating about its axis. The anti-rotation means may comprise the provision of a groove in an outer surface of the bolt member which groove, for example, is engaged by a guiding pin. To secure the bolt member in its retaining position the bolt member, at its end away from the bolt face, may be provided with a securing face which a counter face of the locking element rests against. The locking element is preferably resiliently biased so that its counter face rests against the securing face of the bolt element. The locking element, by way of an outer surface thereof, is then supported on a recess in the sleeve member in which it is received. After having been released, it automatically assumes its securing position.

One of the two faces namely the securing face of the bolt member or the counter face of the locking element may be slightly curved, e.g. part-spherical, in shape in order to allow for production tolerances. Preferably it is the securing face of the bolt member which is of such configuration. Furthermore, in the direction of movement of the locking element towards its securing position, there may be provided some additional freedom of movement of the locking element to provide a reserve of the range of movement and compensate for any wear. It is thus ensured that, in the locking position, contact exists only between the securing face of the bolt and the counter face of the locking element. Preferably

such faces are arranged in such a way that self-inhibition occurs when they are engaged.

As an alternative, it is possible to do without clearance-free locking, in which case the locking element may be pushed by its biasing spring as far as a fixed stop in the bore base, without having any contact with the bolt member. When the coupling journal and coupling sleeve are axially displaced relative to one another in the uncoupling direction, the bolt is firstly pushed back by a small amount before it comes to rest against the counter surface of the locking element. The locking effect of the coupling is thus retained. In this case, the securing face of the locking element may extend parallel to the axis of the bore, because there is no need for a tightening reserve.

For moving the locking element into its releasing position, it may be provided with an outwardly extending actuating pin. The end of such actuating pin may lie in a recess, for example in the outer face of the coupling sleeve or, if the locking element is associated with a special carrier, in such carrier. In a preferred embodiment, the bolt member and locking element are associated with such a separate carrier received in an aperture in the coupling sleeve. Such aperture preferably extends from the outer surface of the coupling sleeve to the bore in the coupling sleeve in which the journal is received, and may be of stepped configuration to facilitate fixing the carrier.

In a further embodiment of the invention, a plurality of bolt members and locking elements may be distributed around the longitudinal axis of the coupling, and associated with the coupling sleeve.

The coupling may provide a connection between the coupling sleeve and coupling journal which, when in the coupled condition, permits no relative movement between the sleeve and journal in the axial direction. Alternatively some relative axial movement may be possible between the coupling sleeve and coupling journal when in the coupled condition.

To achieve the latter connection, it is proposed in a further embodiment of the invention that the movement of the bolt into its retaining

position is limited by a stop, so that some relative movement between the sleeve and journal is possible in the direction along the longitudinal axis.

The relative axial movement may be limited by providing the coupling sleeve with a stop surface engagable with an end face of the coupling journal. In case no relative axial movement is to take place between the coupling sleeve and coupling journal, the end face of the latter may rest against the axial stop surface of the coupling sleeve.

To facilitate movement of the bolt member from its retaining position into its disconnecting position in the course of a coupling operation, it is proposed that the bolt member may, on an end portion thereof facing away from the bolt face, carry a roller element with which the coupling journal is engagable. In the course of a coupling operation, the coupling journal contacts the roller element which, as the coupling sleeve continues to move in the coupling direction relative to the journal, rolls on the journal and moves the bolt members from its retaining position into its disconnecting position.

The coupling sleeve may be provided with centering means cooperable with a tool for operating the locking element or elements to move it or them into its or their releasing position.

Such a tool may form part of a device for holding the coupling sleeve in the course of a coupling or uncoupling operation.

A coupling in accordance with the invention is particularly suitable for use in a drive shaft for a roll in a rolling mill.

The invention will now be described by way of example with reference to the accompanying drawings, of which:-

Figure 1 shows diagrammatically an assembly of a roll stand for a rolling mill and two drive shafts providing respective driving connections with the rolls in the stand and each incorporating a coupling in accordance with the present invention and shown in the coupled condition;

Figure 2 is a view as Figure 1 but showing the couplings in the uncoupled condition;

Figure 3 is a view on an enlarged scale of the coupling as indicated at X in Figure 1;

Figure 4 is an enlargement of the part Y of Figure 3;

Figure 5 is a view corresponding to Figure 4 but with the coupling sleeve approaching an uncoupled position relative to the coupling journal;

Figure 6 is a view as Figure 4 but of an alternative embodiment of coupling according to the invention;

Figure 7 is an illustration corresponding to Figure 3 of a modified embodiment of coupling, showing a detail thereof.

Referring firstly to Figures 1 and 2 of the drawings, these show part of a drive arrangement for the rolls of a roll stand in a rolling mill. A roll drive is indicated at 1, and respective drive shafts 3 connect the drive to the two rolls in the stand 2. Each drive shaft comprises two universal joints 4, 5 connected to one another by a shaft portion 6 which incorporates a sliding torque transmitting device enabling a change in the overall length of the drive shaft, i.e. a change in the distance between the two universal joints 4, 5, to take place. This facilitates changes in the positions of the rolls within the roll stand, and coupling and uncoupling as described hereafter.

In the drive for each roll there is a coupling providing a releasable connection with the roll. Each such coupling comprises a coupling sleeve 7 which is connected to the universal joint 5 nearest the roll and a coupling journal 8 provided on the adjacent end of the roll. The length change possible in the drive shaft enables the coupling to be coupled and uncoupled: in Figure 2 the drive shafts are shown shortened and the coupling sleeves 7 removed from the coupling journals 8. The longitudinal axis of a coupling sleeve is indicated at 12 in Figure 2 and such axis of the corresponding coupling journal at 13 in this Figure: such axes are the axes about which these components rotate in use and when the coupling is in the coupled condition such axes coincide.

In the course of a coupling operation, the coupling sleeve and coupling journal are arranged so that their axes 12, 13 are aligned, and the sleeve is moved

towards the journal in the direction N which herein is referred to as the coupling direction. It would alternatively or additionally be possible for the roll, together with the coupling journal thereon, to be moved so as to approach the coupling sleeve which might be held stationary. A holding device as indicated at 52 in Figure 2 might be provided for supporting the coupling sleeve and the end of the drive shaft at which the sleeve is provided during the coupling operation. Figure 2 also shows a tool 46 cooperating with a coupling sleeve 7 for use during a coupling or uncoupling operation as described hereafter.

Figure 3, on an enlarged scale, shows that the drive shaft 3 has a universal joint 5 whose outermost joint yoke carries a flange 9 to which the coupling sleeve 7 is secured. At its ends adjacent and remote from the flange 9, the coupling sleeve 7 is provided with centering rings 11, 11a which serve to centre the coupling sleeve 7 relative to the coupling journal 8. The cross-sectional shape of the coupling journal 8 differs from the circular, and a bore 23 in the coupling sleeve 7 which receives the coupling journal 8 is of corresponding non-circular cross-sectional shape. The wall of the bore 23 in the coupling sleeve has been given the reference number 24. The longitudinal axis 12 of the sleeve, which is also the axis of the bore 23, is shown at 12. The outer face of the coupling sleeve has been provided with a centering groove 14 for engagement with a centering projection of the tool 46. Indicated generally at 10 in Figure 3 is releasable retaining means described in greater detail hereafter for retaining the coupling sleeve 7 on the coupling journal 8 against removal in the direction opposite the coupling direction N.

The area of Figure 3 indicated at Y is shown in greater detail, in different embodiments, in Figures 4 to 6. The coupling journal 8 is provided in its outer surface 17 with a locking recess 15. The locking recess has a locking face 16 which is inclined at an angle B relative to the longitudinal axis 13 of the journal, the angle B being approximately in the range 45° to 55°. The angle B faces in the direction opposite the coupling direction N of the coupling sleeve 7.

Towards its front end, the coupling journal 8 is provided with a substantially frusto-conical centering face 18. In the region between the centering face 18 and the locking recess 15 (which recess may take the form of a groove extending around the coupling journal 8), there is an outer surface portion 17a. When in the coupled condition, the outer surface portion 17a of the coupling journal and the remainder of the outer surface 17 thereof nearer the roll engage the receiving bore 23 of the coupling sleeve 7. The coupling sleeve 7 is provided with a radially extending aperture 20 which is of stepped configuration and may be, in plan view, of rectangular shape. The retaining means 10 is inserted into the aperture 20. The retaining means contacts a stepped face of the aperture 20 being radially inserted into the aperture from the outside and secured by a number of securing screws as indicated at 22. The carrier 19 extends as far as the wall 24 of the receiving bore 23, and is countersunk relative to the outer face 21 of the coupling sleeve.

In the carrier 19 there is provided a bore 27 whose axis 28 lies in the same plane as the longitudinal axis 12 of the coupling sleeve 7 and is inclined to such axis at an angle A which is an acute angle approximately of 45° to 55°. The angle A faces in the coupling direction N. The bore 27 starts from the inner face of the carrier 19 facing the coupling journal 8 and is a blind bore. Bolt member 25 is accommodated in the bore 27 and is movable along the bore axis 28. An outer surface of the bolt member 25 is provided with a groove 29 which is engaged by a securing pin 30 held by the carrier 19, so that the bolt 25 is prevented from rotating about the axis 28 of the bore 27. Additionally, the securing pin 30 limits the range of free movement of the bolt member 25 in the direction inwards towards the bore 23 of the coupling sleeve, the pin 30 engaging a stop face 50 at the end of the groove 29 to limit such movement.

In the embodiment shown in Figures 3, 4 and 5, movement of the bolt member inwardly towards its retaining position is limited in such a way that the bolt is not able to contact the base of the locking recess in the coupling journal 8. Between end face 49 of the coupling journal and a stop face 48 of the coupling

sleeve facing the end face 49 there is an axial space, so that within limits the coupling journal is able to move axially relative to the coupling sleeve. In the axial direction, the locking recess 15 has to have a corresponding width in order to permit such relative axial movement.

The bolt member 25 has an internal blind bore 32 extending lengthwise of the bolt and which receives a compression spring 31 which also abuts the closed end of the bore 27 in the carrier 19. Thus the bolt member 25 is spring biased radially inwardly with regard to the coupling sleeve 7. In its radially innermost position, which is its retaining position, the end of the bolt member, which has a bolt face 26 followed by an opening face 34, projects inwardly into the bore 23 of the coupling sleeve. The opening face 34 of the bolt member faces the base of the locking recess 15 in the coupling journal and when the bolt is in its retaining position is spaced therefrom by a small distance. The bolt face 26 is disposed at an angle B of 45° to 55° relative to the longitudinal axis 12 of the coupling sleeve, i.e. is perpendicular to the axis 28 of the bore 27 in the coupling sleeve and to the direction of linear movement of the bolt member. This angle B is the same angle as that in which the locking face 16 is disposed relative to the longitudinal axis 13 of the coupling journal 8.

At its end remote from the bolt face 26, the bolt member 25 is provided with a securing face 33 which is cooperable with a locking element 35. The locking element 35 is guided for movement radially of the coupling sleeve in a recess 40 provided in the carrier 19. A body part of the locking element 35 has a counter face 36 which is complementary to the securing face 33 of the bolt member 25. The locking element further comprises an actuating pin 37 which extends radially outwardly of the coupling sleeve through a guiding bore 41 and has an end which projects into a recess 39. The actuating pin 37 does not project radially beyond the extent of the outer face 21 of the coupling sleeve 7. The locking element 35 has an internal blind bore 43 in which is received a compression spring 44 whose other end bears against a retainer 42 screw-threaded into the recess 40 in the carrier 19, so that the locking element 35 is pushed

radially outwardly of the coupling sleeve and its counter face 36 is held in contact with the securing face 33 on the bolt member.

The securing face 33 and counter face 36 are arranged relative to the direction of movement of the locking element 35 at such an angle (smaller than about 5°) that self-inhibition occurs therebetween. In Figure 4 it can be seen that the bolt member 25 engages, by its bolt face 26, the locking face 16 of the locking recess 15 of the coupling journal 8 so that the coupling sleeve is secured against being withdrawn from the coupling journal 8 against the coupling direction N. Any forces acting on the bolt member 25 against the coupling direction N are introduced in a clearance-free way via the securing face 33 onto the counter face 36 of the locking element 35 and thence via the outer face 53 of the locking element into the carrier 19. Either or both of the securing face 33 and the counter face 36, but preferably the securing face 33, is part-spherical in configuration so that any production tolerances are compensated for. The dimensions of the components are arranged so that when the bolt member 25 is supported against the counter face 36 of the locking element 35, the latter is not at the limit of its range of movement relative to the recess 40 in which it is received.

When the coupling is required to be disconnected, a tool 46 is applied to the coupling sleeve as shown in Figure 5. The tool 46 has a centering projection 47 engagable with a centering groove 14 provided in the outer surface 21 of the coupling sleeve. The tool carries a radially displaceable actuating pin 45 which, when the centering projection 47 of the tool is positioned in the centering groove 14, is aligned with the actuating pin 37 of the locking member of the coupling and is engagable with an end face 38 of the actuating pin. When the actuating pin 45 of the tool is displaced inwardly, the locking element 35 is correspondingly displaced radially inwardly from the position in which it is shown in Figure 4 in the position in which it is shown in Figure 5. The counter face 36 of the locking member is moved away from the securing face 33 of the bolt member, so that the latter is no longer held against movement within its bore.

By moving the coupling sleeve 7 against the coupling direction N relative to the coupling journal, the bolt member 25 is moved against the force of the spring 31 into its disconnecting position in which it is shown in unbroken lines in Figure 5. The bolt face 26 of the bolt member 25 slides on the locking face 16 of the locking recess 15 of the coupling journal 8, until the opening face 34 of the bolt member comes to rest on the portion 17a of the outer face of the coupling journal, enabling the coupling sleeve to leave the coupling journal. As soon as such movement has reached the point where the bolt member has reached the region of the centering face 18 of the coupling journal, the bolt member under the action of its spring 31 is again moved into its inwardly displaced retaining position wherein the bolt face 26 projects inwardly beyond the wall 24 of the bore 23 in the coupling sleeve.

In the course of a coupling operation, the movements above described are reversed. When the coupling sleeve 7 is slid on to the coupling journal 8 in the direction N, the centering face 18 of the journal moves the bolt member 25 into its disconnecting position until the bolt member reaches the locking recess 15 whereupon the bolt member under the action of spring 31 is again displaced inwardly.

In the alternative embodiment shown in Figure 6 of the drawings, the bolt member 25 is provided instead of opening face 34 with a roller 51. The roller 51 engages the centering face 18 and surface portion 17a in the course of a coupling operation as above described, so that in analogous manner the bolt member 25 is subject to a force which moves it into the disconnecting position until the locking recess 15 in the coupling journal has been reached.

After the position has been reached in which the bolt member has engaged the locking recess 15 in the coupling journal, the locking element 35 is released by moving out the actuating pin 48. The locking element by means of its counter face 36 then engages the securing face 33 of the bolt member to secure the latter in its retaining position. In the embodiments according to Figures 3 to 5, movement of the bolt member is limited by engagement of the

securing pin 30 with the stop face 50 of the groove 29 of the bolt member. The tool 46 is subsequently removed from the coupling.

The tool 46 may form part of a holding device 52 which bolts the coupling sleeve 7 at a position in which it is able to carry out coupling and uncoupling operations. In the case of rolling mill drives, there is provided such a holding device 52 for use when rolls are changed.

As well as by virtue of the provision of the roller 51, the embodiment shown in Figure 6 differs from that of Figures 3 to 5 in that the coupling sleeve 7 is provided additionally with a central bore in which is received a bush having a collar which affords an axial stop face 48 engagable with end face 49 of the coupling journal 8. The coupling journal further has a centering projection 47 engagable within the bush. In the coupled condition, there is no freedom for the coupling sleeve to move axially relative to the coupling journal because of the engagement of the end face 49 of the journal with the face 48 of the collar, and because clearance are taken up between the bolt member and locking member. In the course of a coupling operation, inward movement of the bolt member continues until the aforesaid firm contact is established which takes place before the securing element 30 is in contact with the end of the groove 29. When the actuating pin of the locking element is released and the locking element can move outwardly to engage the bolt member, any outward movement of the latter is prevented. The roller 51 is rotatably supported on the bolt member 25 on an axis which is perpendicular to and spaced from the axis of movement of the bolt member 25.

In Figure 7 there is shown an embodiment wherein, when the bolt member has moved inwardly until stop face 50a at the end of groove 29 therein engages the securing pin 30, a clearance 54 exists between the securing face 33 of the bolt member 25 and the counter face 36 of the locking element 35. This condition exists when the outward movement of the locking element is limited by abutment thereof with the base 55 of the recess 50 in the carrier 19. From the coupled condition illustrated in Figure 7, if the coupling journal 8 is moved

relative to the coupling sleeve in the direction N, the bolt member 25 is pushed outwardly by engagement of the locking face 16 with the bolt face 26 until the securing face 33 of the bolt member abuts the counter face 36 of the locking element 35. Further movement of the bolt member is then prevented. The counter face 36 of the locking element extends parallel to the axis of sliding movement of the locking element.

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS

1. A coupling comprising a coupling sleeve and a coupling journal between which a releasable connection can be established, the coupling sleeve comprising a bore in which the coupling journal is received when in the coupled condition, the journal being insertable into the bore in the sleeve lengthwise of a longitudinal axis of the sleeve and journal, and there being releasable means for retaining the sleeve relative to the journal, against disconnection by relative movement therebetween in the opposite direction; such releasable means comprising a locking recess provided in an outer surface of the coupling journal and having a locking face, a bolt member having a bolt face cooperable with the locking face and which is movable between a retaining position, in which its bolt face projects inwardly of the bore of the coupling sleeve and a disconnecting position, in which it is withdrawn from the bore, there being a resiliently biased locking element for locking the bolt member in its retaining position and which can be, by application of an external force, moved into a releasing position, wherein the bolt member is resiliently biased towards its retaining position and, when the locking element is in its releasing position, can be displaced into its disconnecting position by movement of the coupling sleeve relative to the coupling journal opposite the coupling direction, and reassume its retaining position when external force is no longer applied; the axis of the bore wherein the bolt member is received lying in the same plane as the longitudinal axis of the coupling sleeve and intersecting said longitudinal axis at an acute angle facing in the coupling direction.

2. A coupling according to Claim 1 wherein the bolt member is of elongate configuration and is movable lengthwise in a bore, an end face of the bolt member constituting the bolt face.

3. A coupling according to Claim 2 wherein the bolt face of the bolt member is inclined to the longitudinal axis of the bore in the coupling sleeve and the locking face of the locking recess is inclined to the longitudinal axis of the coupling journal at identical angles to one another.

4. A coupling according to Claim 3 wherein said angles are acute angles facing in the direction opposite the coupling direction.

5. A coupling according to any one of Claims 2 to 4 wherein the bolt member is of cylindrical configuration and means is provided to prevent it from rotating about its axis within its bore.

6. A coupling according to any one of the preceding claims wherein the bolt member, at its end away from the bolt face, is provided with a securing face engagable with a counter face of the locking element.

7. A coupling according to Claim 6 wherein the locking element is resiliently biased into its securing position, and wherein, when the bolt member engages the locking element, the locking element is supported by an outer surface thereof engaging a recess in which the locking element is received.

8. A coupling according to any one of Claims 1 to 7 wherein the locking element comprises an actuating pin projecting outwardly of the coupling sleeve.

9. A coupling according to Claim 8 wherein the end of the actuating pin lies in a recess.

10. A coupling according to any one of the preceding claims wherein the bolt member and locking element are associated with a carrier received in an aperture in the coupling sleeve.

11. A coupling according to any one of the preceding claims wherein a plurality of bolt members and locking elements are disposed about the longitudinal axis of the coupling sleeve.

12. A coupling according to any one of the preceding claims wherein, when in the coupled condition, the coupling sleeve and coupling journal are movable relative to one another axially, and movement of the bolt member into its retaining position is limited by a stop.

13. A coupling according to any one of the preceding claims wherein the coupling sleeve is provided with a stop surface engagable with an end face of the coupling journal.

14. A coupling according to Claim 13 wherein the bolt member holds the coupling sleeve relative to the coupling journal in a relative position wherein the coupling journal engages said stop surface.

15. A coupling according to any one of Claims 1 to 13 wherein the bolt member, at an end portion thereof facing away from the bolt face, carries a roller element with which the coupling journal is engagable.

16. A coupling according to any one of the preceding claims wherein the coupling sleeve is provided with centering means for cooperation with a tool for operating the or each locking element to move it to its releasing position.

17. A coupling according to Claim 16 wherein said tool forms part of a device for holding the coupling sleeve in the course of a coupling or uncoupling operation.

18. A coupling substantially as hereinbefore described with reference to the accompanying drawings.

19. Any novel feature or novel combination of features described herein and/or in the accompanying drawings.